

REMARKS

Claims 26-33 and 52-64 are pending in the present application and stand allowed.

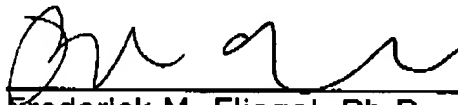
The amendments to the specification address minor Informallities noted during review. No new matter is added by the amendments to the specification. Entry of the amendments to the specification is requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) are captioned "**Version with markings to show changes made.**"

A telephonic interview is requested in the event that the next office action is one other than a Notice of Allowance. The undersigned is available during normal business hours (Pacific Time Zone).

Respectfully submitted,

Dated: Mar. 4, 2002

By: 
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Reg. No. 36,138

Version with markings to show changes made**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application Serial No. 09/536,037
Filing Date March 27, 2000
Inventor Weimin (Michael) Li
Assignee Micron Technology, Inc.
Group Art Unit 2822
Examiner T. Thomas
Attorney's Docket No. MI22-1398
Title: Low k Interlevel Dielectric Layer Fabrication Methods

37 CFR §1.121(b)(1)(iii) AND 37 CFR §1.121(c)(1)(ii)
FILING REQUIREMENTS TO ACCOMPANY PRELIMINARY AMENDMENT

Deletions are bracketed, additions are underlined.

In the Specification

On page 2, the paragraph spanning from line 5 to line 21 has been amended as shown below:

One way of reducing the dielectric constant of certain inherently insulative materials is to provide some degree of carbon content therein. One example technique for doing so has recently been developed by Trikon Technology of Bristol, UK which they refer to as Flowfill[™] Technology. Where more carbon incorporation is desired, methylsilane in a gaseous form and H_2O_2 in a liquid form are separately introduced into a chamber, such as a parallel plate reaction chamber. A reaction between the methylsilane and H_2O_2 can be moderated by introduction of nitrogen into the reaction chamber. A wafer is provided within the chamber and ideally maintained at a suitable low temperature, such as $0^\circ C$, and at [a] an exemplary pressure of 1 Torr to achieve formation of a methylsilanol structure. Such structure/material condenses on the wafer surface. Although the reaction occurs in the gas phase, the deposited material is in the form of a [viscus] viscous liquid which flows to fill small gaps on the wafer surface. In applications where deposition thickness increases, surface tension drives the deposited layer flat, thus forming a planarized layer over the substrate.

On page 4, the paragraph spanning lines 14-21 has been amended as shown below.

In one implementation, a low k Interlevel dielectric layer fabrication method includes providing a substrate having integrated circuitry at least partially formed thereon. An interlevel dielectric layer comprising a compound having silicon bonded to both nitrogen and an organic material and having a dielectric constant no greater than 8.0 [over] is formed over the substrate. After forming the dielectric layer, It is exposed to a plasma comprising nitrogen effective to reduce the dielectric constant to below what it was prior to said exposing.

The paragraph spanning from page 7, line 20, to page 8, line 15, has been amended as shown below:

In a more specific example, methylsilane or trimethylsilane is combined with N_2O in a reaction chamber. A pressure within the chamber is maintained at from about 300 mTorr to about 30 Torr, and is preferably maintained at from about 1 Torr to about 10 Torr. An exemplary reaction chamber comprises a spacing between the plates of from about 400 mils to about 600 mils with methylsilane being flowed into the chamber at a rate from about 25 standard cubic centimeters per minute (sccm) to about 2000 sccm (preferably at from about 50 sccm to about 250 sccm). The N_2O is flowed into the reaction chamber at a rate from about 50 sccm to about 3000 sccm (preferably at a rate from about 100 sccm to about 1500 sccm, and more preferably at a rate of from about 500 sccm to about 1200 sccm), and, additionally, helium is flowed into the reaction chamber at a rate of about 500 sccm to about 5000 sccm (preferably from 1000 sccm to about 3000 sccm). A radio frequency (RF) power within the chamber is maintained at from about 50 watts to about 500 watts, and preferably from about 100 watts to about 200 watts. The semiconductor substrate (such as a monocrystalline silicon wafer) is provided within the chamber and maintained at a temperature from about 25° C to about 450° C.

The paragraph spanning from page 11, line 16, to page 12, line 14, has been amended as shown below:

The preferred wafer surface temperature during the exposing is always less than or equal to 550° C, with the exposing also preferably being conducted at subatmospheric pressure. The oxygen comprising plasma is preferably derived at least in part from at least one of O₂, O₃, N₂O, and NO_x. Preferred parameters for the exposing in a dual plate capacitively coupled reactor include an RF power range of from 300 to 1000 watts, a pressure range of from 1 Torr to 6 Torr, a temperature range of from 100° C to 450° C, a spacing between the plates of from 400 to 600 mils, an oxygen gas exposure flow of from 500 to 1500 sccm, an inert gas flow (i.e., He and/or Ar) of from 200 sccm to 800 sccm, and a treatment time of from 20 to 100 to more seconds. It is a preferred intent of the exposing to further not transform [a whole of] the whole or all of the dielectric layer from one base chemistry to another base chemistry by the exposing. An outermost portion of the exposed layer might experience a slight reduction in carbon content, but otherwise that portion and the whole of the layer is not transformed from one fundamental material to another even in spite of the low k reducing or resulting property. In one preferred aspect of the invention, the exposing comprises at least 20 seconds of processing time. More preferably and in preferred sequence, the processing comprises at least 40 seconds, 60 seconds, 80 seconds, and 100 seconds of oxygen containing plasma exposure. The plasma exposing is preferably ineffective to appreciably etch the interlevel dielectric layer.

The paragraph spanning from page 13, line 16 to page 14, line 2, has been amended as shown below:

An exemplary specific reaction is to combine methylsilane (CH_3SiH_3) with NH_3 in the presence of a plasma to form $(\text{CH}_3)_x\text{Si}_3\text{N}_{(4-x)}$. The exemplary reaction can occur, for example, under the following conditions. A substrate [if] is placed within a reaction chamber of a reactor, and a surface of the substrate is maintained at a temperature of from about 0°C to about 600°C . Ammonia and methyl silane are flowed into the reaction chamber, and a pressure within the chamber is maintained at from about 300 mTorr to about 30 Torr, with a plasma at a radio frequency (RF) power of from about 50 watts to about 500 watts. A product comprising $(\text{CH}_3)_x\text{Si}_3\text{N}_{(4-x)}$ is then formed and deposited on the substrate.

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